TECHNICAL MEMORANDUM

for

SA6 CONTAMINATED SEDIMENT REMOVAL OPERATIONS

Portage Creek Area Removal
Kalamazoo, Michigan

Prepared for:

USEPA Region 5
Emergency Response Branch
77 West Jackson
Chicago, IL 60604

Contract No. EP-S5-08-02
Task Order No. 0087

EQ Project No.: 030281.0087

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CONTENTS

FIGURES

No. **Page**

TABLES

No. **Page**

1. INTRODUCTION

Environmental Quality Management, Inc. (EQ) has been tasked with performing a time-critical-removal action (TCRA) to remove polychlorinated biphenyl (PCB) contaminated sediments from targeted locations over a 1.8-mile section of Portage Creek. The Portage Creek Area Site (Site) is a portion of the Allied Paper/Portage Creek/Kalamazoo River Superfund Site. Located in Kalamazoo County, Michigan, this site is pervasively contaminated with PCBs as a result of historic waste practices associated with several paper mills. The Site was listed on the National Priorities List (NPL) on August 30, 1990. The Portage Creek Site is located in the City of Kalamazoo, Michigan, beginning at East Cork Street and extending northward approximately 3 miles to the confluence of the Kalamazoo River. Activities associated with this removal action are anticipated to occur in segments along a 1.8-mile stretch of Portage Creek. Work activities will move downstream primarily between Reed Avenue to East Walnut Street bridge, South Pitcher Street bridge to the railroad crossing west of Rochester Street, and the bend in Portage Creek east of Rochester Street to the confluence with the Kalamazoo River (Figure 1, Site Location Map).

A comprehensive description of the project is provided in the Work Plan (composed of sediment removal area Technical memorandums and other site documents) for the Portage Creek Area Time-Critical Removal Action. The section of Portage Creek targeted for action has been divided into 10 distinct removal areas (Figure 2, Sediment Removal Areas). The areas targeted for removal will be referred to as SA1-A, SA1-B, SA1-C, SA3-A, SA5-A, SA5-C, Axtell Creek, SA5-D, SA6, and SA7. This technical memorandum will focus on establishing support facilities and contaminated soil removal operations in the SA6 Area. Approaches described in this technical memorandum supersede all other removal approaches discussed to date in related submittals.

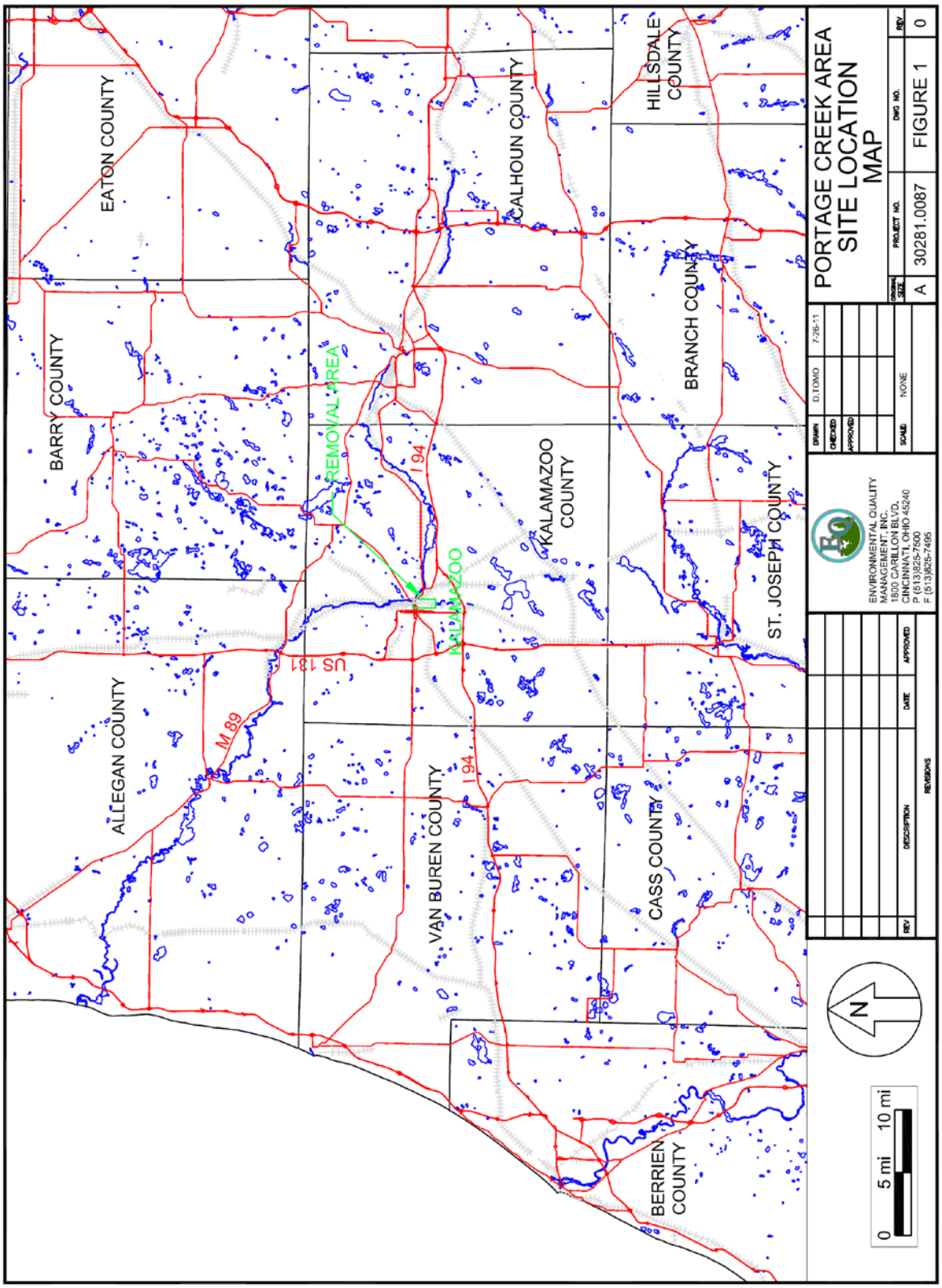

Figure 1. Site Location

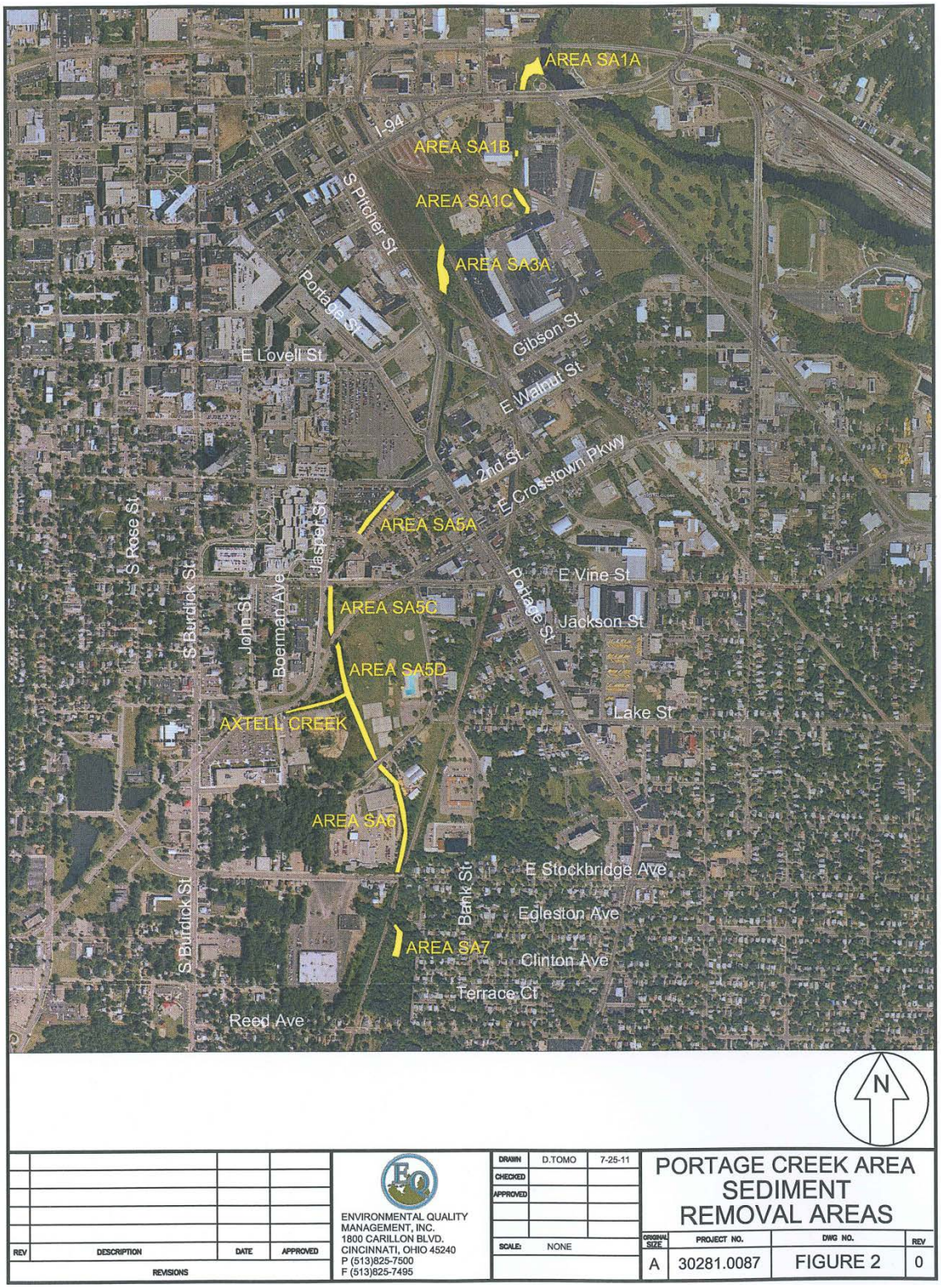

Figure 2. Sediment Removal Areas

2. PROJECT PREPARATION

EQ will perform the following activities to prepare the Portage Creek Area Site for contaminated sediment excavation in SA6.

2.1 Limb and Brush Removal Support for Pre-Survey SA6

EQ will provide a foreman and three laborers to remove limbs and brush to enable the USEPA FIELDS Group to acquire line-of-site access for survey instruments and to obtain preliminary elevation data to create design drawings for sediment removal in Area SA6. Crews will be equipped with hand saws, looping shears, and pole pruners. Crews will clear limbs and brush as necessary at grids SA6-1 through SA6-14 to create line-of-sight access for survey instruments. This effort is expected to be completed in 15-20 workdays.

2.2 Pre-excavation Sampling of Data Gap Area SA6

2.2.1 Sampling

EQ will conduct sampling at dredging area SA6 to further define the extent of contamination and to finalize the removal depths required. SA6 grids that require pre-dredging sampling are SA6-1, SA6-6, SA6-10, SA6-11, SA6-13, and SA6-14. Sampling efforts will be performed jointly with the USEPA START Contractor. EQ will supply sampling equipment and supplies. The START representative will be responsible for sample preparation and labeling, completing chain-of-custody, and packaging samples for shipment. Details regarding sampling, procedures, and protocols are presented in the Field Sampling Plan (FSP) and the Quality Assurance Project Plan (QAPP). In addition, EQ will collect samples so that waste characterization analyses can be conducted as part of the process for securing disposal acceptance of the TSCA waste soils/sediments and Subtitle D waste soils/sediments.

2.2.2 Analyses

EQ will provide laboratory analyses of the collected samples. Details regarding sample analyses, turnaround time, and QAQC levels are presented in the FSP and QAPP.

3. SA6 CONTAMINATED SEDIMENT REMOVAL

The SA6 dredging area lies to the north of the East Stockbridge Avenue bridge and extends north to the Lake Street bridge. It is bordered on the east by the Grand Elk railroad, property owned by the School District of Kalamazoo, and a private residence. Property on the west side of Portage Creek is a maintenance vehicle yard owned by the City's Public Services Department. The sediment removal depth extends from 18 to 36 inches below the existing creek bottom which includes an estimated 6 inches of over-dredge depth.

The overall surface area of the dredging is anticipated to be approximately 3,392 square yards (sy). The approximate overall dimensions are 832 ft long by 37 ft wide. EQ will dredge sediments that will require TSCA disposal (approximately 68 cubic yards (cy)) and sediments requiring non-TSCA disposal at a Subtitle D Landfill (approximately 2,777 cy). The SA6 Dredging Area was originally subdivided into 14 grids (SA6-1 through SA6-14); however, pre-excavation sampling results eliminated SA6-1 as a high-priority removal area. Therefore, contaminated sediment removal will only take place in Grids SA6-2 through SA6-14. All 13 grids will have sediments that require non-TSCA disposal. SA6-13 and SA6-14 are the only grids that require TSCA disposal. The sediment dredging areas are depicted in Figure 3, SA6 Dredging Areas. When dredging operations are conducted in Grids SA6-13 and SA6-14, EQ will first remove the TSCA soils prior to removing the Subtitle D material. Dredging in this manner will allow for segregation of the TSCA material from the Subtitle D material. Table 1 summarizes excavation information specific to Area SA6.

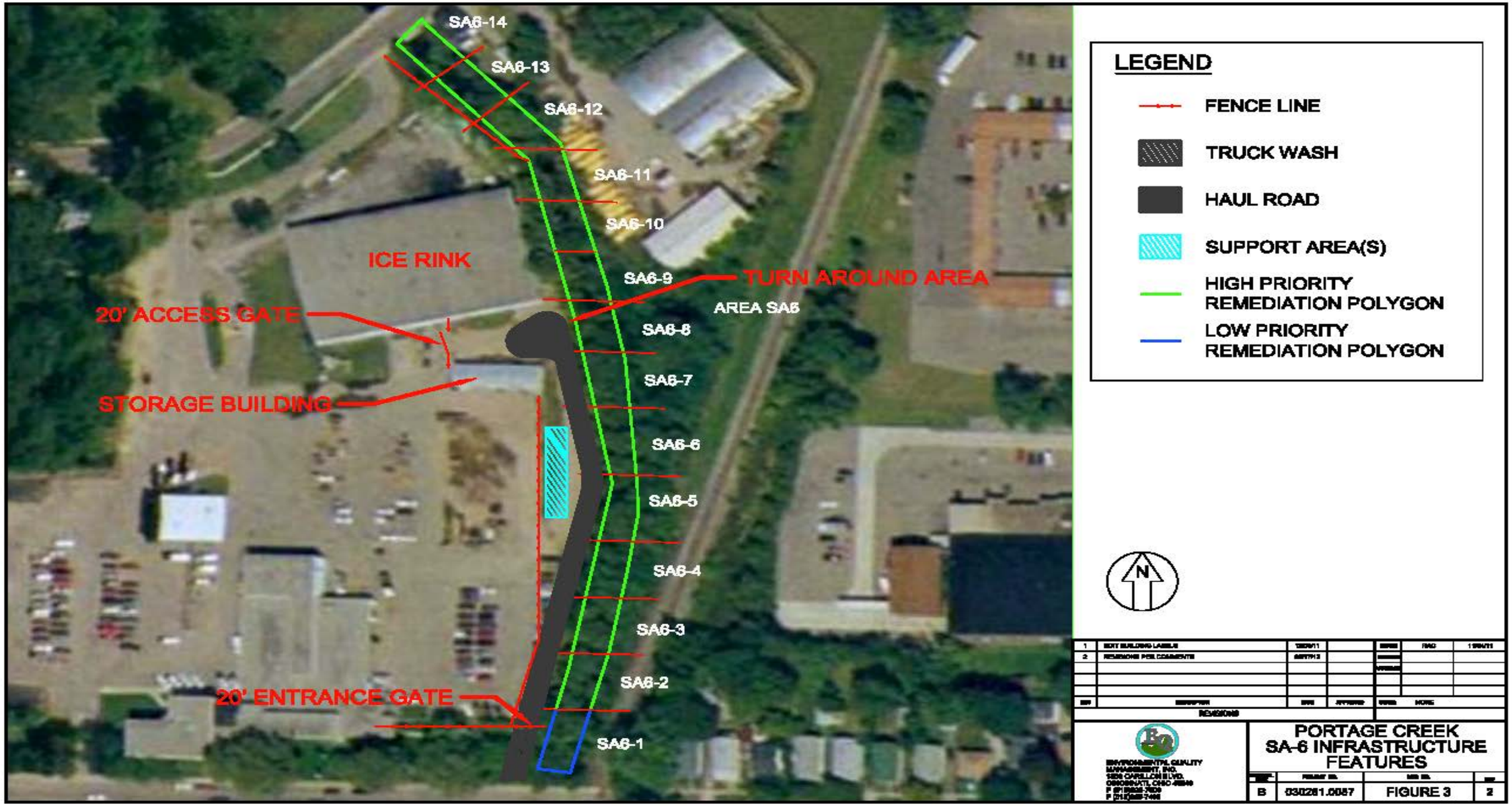

Figure 3. SA6 Dredging Areas

Table 1. Excavation Details

Excavation Area	Dimensions	Removal Depth	Surface Area/Volume of TSCA Soils	Surface Area/Volume of Subtitle D Soils
SA6-2	33.5’ W by 69’ L	30”	0/0	2311 sf/214 cy
SA6-3	36’W by 64’ L	30”	0/0	2304 sf/213 cy
SA6-4	34’ W by 70’ L	30”	0/0	2380 sf/220 cy
SA6-5	30’ W by 76’ L	36”	0/0	2280 sf/253 cy
SA6-6	30’ W by 79’ L	36”	0/0	2370 sf/263 cy
SA6-7	37.5’ W by 60’ L	30”	0/0	2250 sf/208 cy
SA6-8	42’ W by 67’ L	18”	0/0	2981 sf/166 cy
SA6-9	44.5’ W by 56’ L	30”	0/0	2492 sf/230 cy
SA6-10	42.5’ W by 57’ L	36”	0/0	2422 sf/269 cy
SA6-11	38’ W by 57’ L	30”	0/0	2166 sf/200 cy
SA6-12	37.5’ W by 57’ L	30”	0/0	2137 sf/198 cy
SA6-13	37 W by 64’ L	30”	456 sf/42 cy	1912 sf/177 cy
SA6-14	37’ W by 56’ L	30”	276 sf/ 26 cy	1796 sf/166 cy

3.1 Pre-Sediment Removal Preparation

3.1.1 Waste Characterization Sampling of TSCA/Subtitle D Soil

EQ will collect characterization soil samples of the TSCA and Subtitle D soils prior to excavation. The EQ FSP dated August 2011 provides information on the number of samples, collection method, and exact analyses to be performed. Both the TSCA and Subtitle D waste soils will be analyzed for landfill disposal parameters.

3.1.2 Pre-Sediment Removal Condition Assessment

EQ will provide a structural engineer to perform a pre-sediment removal assessment of constructed features in and adjacent to the creek channel excavation areas. These constructed features include but are not limited to bridges, storm sewer outfalls, retaining walls, building foundations, and fences. The structural engineer will:

- Inventory the constructed features in the work zones by performing a physical inspection and construction records review.
- Document the pre-existing condition with a written assessment and photographs.
- Prescribe protective measures to maintain the current condition such as (but not limited to) safe set-back distance, shielding, and shoring.

3.1.3 Relocation of Fence Line

EQ will need to temporarily modify the current boundary fence configuration for the Kalamazoo Public Services Facility located at 410 Stockbridge Avenue. This will require modifications to the south and east fence line to allow EQ a sufficient work area along the west side of the creek while remaining isolated from operations at the Kalamazoo Public Services Facility. EQ will temporarily relocate the fence line from SA6-1 to SA6-8 to prepare the site for further work and to maintain site security. This will also require installing a temporary entrance gate that will allow access to and from the work area from Stockbridge Avenue. A second gate will be installed between the Ice Rink Building and the Storage Building to allow the city access to the southeast large bay door on the Ice Rink Building while permitting EQ access to space between buildings to allow sediment transfer trucks to turn around. A third temporary entrance gate will be installed to secure the work area and allow for light vehicle and personnel traffic on the west side of the creek at the Lake Street bridge. EQ will also modify the fence alignment in the northeast corner of the property to improve access for clearing and grubbing, and permit long-reach excavator access for sediment removal in SA6 Grids 13 and 14. This will involve moving the fence back approximately 20 feet near Lake Avenue to <8 feet as the fence alignment approaches the Ice Rink Building. The temporary fence alignment and location of gates are depicted in Figure 3, SA6 Infrastructure Features.

EQ will procure a subcontractor to relocate the fence line. The fencing subcontractor will install new line/corner/anchor posts in the agreed-upon alignment with the City. The subcontractor will disassemble the existing fence line by removing the chainlink fence fabric and appurtenances and relocate/install it on the new line/corner/anchor posts. Original line posts will then be removed and either staged in a protected area for re-use or disposed of as scrap if not suitable for re-use. New fence appurtenances will be provided where existing items cannot be re-used.

3.1.4 Clearing and Grubbing of Access Road and Excavation Area

EQ will clear and grub the eastern and western bank of the creek channel along the entire length of SA6 to facilitate use of Real Time Kinetic – Ground Positioning System (RTK-GPS), dewatering pipeline installation, dredging, and removal of contaminated sediments off site.

Clearing and grubbing of vegetation will extend from south of the Lake Street bridge to just north of the Stockbridge bridge crossing. EQ also intends to perform all clearing and grubbing in such a manner to protect the root mass in the overall work area to maintain soil stability. EQ will use a brush hog mower affixed to a posi-track loader to clear underbrush from the creek banks where accessible. The creek banks in many locations along the creek channel have a steep grade with 5 ft to 7 ft of relief. The brush hog operation will be conducted perpendicular to the creek bank to permit the operator to work in the safest manner.

Tree removal along the southern half of the SA6 work area is complicated by the presence of aboveground high-voltage electric power lines and telecommunication lines. These lines are installed over the creek channel or extremely close to the stream channel from the bridge at Stockbridge Avenue north approximately 500 ft. EQ has contacted Consumers Energy Corporation and has determined that it is not possible to temporarily relocate or shield the high-voltage electric lines.

Limbs and trunk sections will be secured with non-conductive ropes/cables and lowered to the ground to prevent contact with the power lines. Laborers equipped with chain saws, looping shears, and pruning saws will then fell trees along the western creek bank. Tree felling will be supported by an excavator with a thumb attachment, and a rubber-tire loader to assist with handling and processing of vegetation. Tree tops and tree trunks will be handled as described in the EQ Debris Management Plan Dated September 2011.

3.1.5 Environmental Controls

EQ will install environmental controls per requirements established in the EQ Sedimentation and Erosion Control Plan dated September 2011. These environmental controls will include the following Best Management Practices (BMPs):

- Storm Drain Inlet Protection—EQ will install filtration fabric in storm drain inlets in the EQ work area as well as potentially affected inlets in the Kalamazoo Public Service Yard, and along Stockbridge Avenue 100 ft east and west of EQ's construction entrance.
- Construction Entrance—EQ will install a construction entrance off Stockbridge Avenue through the greenbelt up to the paved southeast corner of the Kalamazoo Public Services Facility. The construction entrance will consist of an 8-ounce geotextile underlayment with a

6-inch-thick layer of 1- to 3-inch rock or HDPE construction mats. The construction entrance will be approximately 15 ft wide.

- Tire Wash Station—EQ will install and operate a tire wash station at the south end of the construction entrance. The tire wash station will consist of a portable berm with collapsible sides and reinforced seams to contain liquids with rubber mats suitable for supporting loaded dump trucks. After each truck is loaded with exhumed sediment, laborer(s) equipped with high-pressure water washer(s) will spray off the dirt from truck tires as they pass through the tire wash station prior to exiting the site. The dislodged dirt and water will be captured in the portable berm. Wash waters will periodically be pumped into a frac tank staged nearby and trucked to the waste water treatment plant to maintain suitable storage capacity. Additional periodic maintenance will be required to remove sediment accumulations, which will be solidified and loaded into transfer trucks to be shipped to the John Street TCRA staging pad.
- Paved Surface Management—EQ will provide a power broom with a water tank to perform housekeeping of the paved work areas.
- Dust Control—EQ will provide a water truck for dust control for the mixing area and truck route.
- Spill Kit - EQ will also provide emergency spill control kits that will include drums, oil dry, adsorbent pads, and a boom to address small spills.
- Sediment Curtain—EQ will install one or more Type II sediment curtains downstream of sediment removal operations and will also install one sediment curtain downstream of the Lake Street Bridge perpendicular to the stream flow. Additional curtain(s) will be installed downstream of the cofferdams and bypass pumping discharge pads if necessary.
- Silt Fence—EQ will install a silt fence at the bottom of the slope between SA6-2 and SA6-14 and will install a silt fence along the east side of the length of the creek channel. Additional silt fencing will be installed as needed.
- Mulch Blanket—EQ will install a mulch blanket at the bottom of the slope between SA6-5 and SA6-8. EQ will install additional mulch blanket as needed.
- Energy Dissipation Pads—When EQ isolates an excavation area, bypass pumping will be required to maintain creek flow. EQ intends to address the entire sediment removal area by dividing it into three isolated sections and completing dredging, post removal toe-of-bank stabilization, and backfilling one isolated section at a time before addressing an adjacent section. This may be modified by adding sections if a particular section's dewatering load is determined to be greater than the capacity of the waste water treatment plant. Therefore, EQ will install one or more energy dissipation pads downstream of the SA6-14 cofferdam through which the discharge lines of the various bypass pumps will be directed to release their water. The energy dissipation pads will consist of 3 or more gabion baskets filled with 4-7 inch rock. The end sections of the HDPE discharge pipe will disperse water flow over the gabion baskets. These dissipation pads will be moved and reused if possible as work progresses downstream.
- Turbidity Monitoring Station—EQ will establish turbidity monitoring station(s) to monitor the turbidity levels during removal operations consistent with the Field Sampling Plan.

Additional environmental controls will be implemented as needed to supplement pre-construction controls as work progresses and site features are impacted by the sediment remediation activities.

3.1.6 Access Road Construction

EQ's work area access to the creek will be limited to the eastern portion of the Kalamazoo Public Services facility from Stockbridge Avenue north to the south end of the Ice Rink Building and from the west creek bank west to the east side of the Storage Building, with the exception of the space between the Ice Rink Building and the Storage Building where sediment transport trucks will be allowed to turn around. The access road will serve as a work bench for the excavators when removing sediments from the top of the creek bank, and as a service road to allow sediment transfer vehicles to enter the site, be loaded with sediment, and exit the site to transfer material back to the John Street TCRA support facility to stage and stabilize sediments prior to shipment for final disposal. Transfer trucks will enter and exit the sediment removal area through this access road.

The access roadway will be created parallel to the west bank of the creek channel. This access roadway will extend back to the southeast corner of the maintenance building, traversing over paved and vegetated covered areas. EQ will make no improvements to the roadway route when traversing over paved locations.

EQ will install an 8-ounce geotextile underlayment with a 6-inch-thick layer of 1- to 3-inch rock covered by a 2- to 3-inch layer of <1 inch gravel or utilize construction mats when traversing over vegetated areas. This roadway will be 20 feet wide where possible to allow for 2-way truck traffic and a minimum of 12 feet wide where space is limited. Sand bags and plastic liner will be placed along the fence line bordering the access roadway to limit surface water run-off onto the adjacent municipal lot.

3.1.7 Dredging Area Isolation

EQ will install a series of sheet pile cofferdams to isolate the dredging areas and facilitate dredging area dewatering to permit both "dredging-in-the-wet" and "dredging-in-the-dry" of the contaminated sediments. EQ intends to subdivide SA6 dredging into three isolated sections to facilitate sediment removal operations. The proposed isolated sections are SA6 2-6, SA6 7-10, and SA6 11-14. The first isolated section (SA6 2-6) will be excavated by "dredging-in-the-wet." This approach has been selected to mitigate risk of damaging a sanitary sewer force main installed in close proximity to the west side of the creek where it crosses the creek in Grid SA6-6. This approach was selected due to concerns of force main destabilization and damage that could result from vacuum dewatering of sediments in the excavation area. EQ intends to excavate SA6 7-10 and SA6 11-14 using a "dredging-in-the-dry" approach. Details concerning these two approaches are provided in subsequent sections. EQ may modify this approach once the dredging activity has started if groundwater recharge conditions exceed waste water treatment system capacity. In addition to installing cofferdams across the creek channel, EQ may install smaller 3-sided cofferdams around storm drain outlets to further isolate the dredging areas from storm water drainage. There is one known outlet near the Kalamazoo Public School Lake Street Barn property that will require a cofferdam. EQ will set a 6-inch bypass pump and appropriate hoses/piping to facilitate pumping from the storm outlet to downstream of the excavation areas.

These cofferdams will be completed to an elevation approximately 6 inches above the average creek water level elevation. The elevation completion height has been specified by USEPA to allow storm water overflow into the isolated excavation area in the event of bypass pumping failure and/or a storm event to prevent upstream flooding due to sediment removal operations.

EQ intends to install all cofferdams prior to commencement of dredging operations, and maintain bypass pumping of the creek channel around the entire excavation area throughout the dredging and creek channel restoration process. Three of the coffer dams (at upstream end of SA6-2, downstream end of SA6-6, and SA6-10) will be constructed with sheet piling and the fourth (at SA6-14) will be constructed of large sandbags. The coffer dams will be removed once the total removal area is complete.

3.1.8 Bypass Pumping

EQ will provide a dewatering subcontractor to perform bypass pumping operations. Bypass pumping will consist of rerouting two distinct sources of water away from the isolated dredging area and discharging it back into the creek below the downstream isolation cofferdam. The two water sources are listed below:

- Creek channel flow
- Storm water outlet flow

Creek channel bypass pumping will consist of capturing the stream flow from the creek from above the upstream isolation cofferdam and pumping it past the downstream isolation cofferdam and discharging captured creek waters onto an energy dissipation pad installed by EQ. Bypass pumping capacity will be specified to exceed 2 times the average creek flow of approximately 45 cfm. The subcontractor will also be required to provide redundant pumps and ancillary equipment to allow for maintenance of the pumping systems without impacting dredging operations. Bypass pumping operations will be described in the subsequent water management subsection. The bypass pumping systems will be installed concurrently with installation of the up/downstream isolation cofferdams.

Storm water outlet bypass pumping will be performed as needed from storm sewer outfall(s) that have been coffer dammed to prevent flow into an active excavation area. There are two known storm water outlets into the SA6 dredging area. One 10-inch outlet will impact the isolated dredging area SA6 2-6, and one 24-inch outlet will impact dredging area SA6 9-14. The 10-inch outlet impacting SA6 2-6 will be re-routed by extending the PVC pipe into adjacent isolated dredging areas to avoid impacts on operations. A coffer dam will be installed around the 24-inch outlet from impacting areas SA6 9-14 and a 6-inch pump with ancillary equipment will be used to divert this storm sewer outlet.

3.1.9 Dredging Area Dewatering

Groundwater depression pumping will be performed to minimize groundwater recharge and dewater sediments to the isolated creek dredging areas that span SA 6 7-14 to minimize dredging area sediment dewatering and subsequent waste water treatment. Groundwater depression

pumping will be accomplished by installing a series of 2-inch by 20-foot-deep Silter Vac vacuum wells on 15-foot centers along both sides of the creek, each with 3 feet of geotextile filter assembly around the bottom of the Silter Vac well. Pumping down groundwater from a zone below the excavation will draw water down through the soil matrix and thus will deposit PCB contaminants as they are affixed to sediment particles in the excavation zone. Groundwater will be discharged back into the creek since PCBs will not be present in the groundwater. In addition, a series of 1 1/4-inch by 20-foot-deep Silter Vac vacuum points will be installed at 5-foot centers across the creek perpendicular to the 2 lines of Silter Vac wells to divide the SA6 area into 3 isolated sections. A vacuum will be placed on the Silter Vac wells to extract water from the sediment. Approximately 10 to 14 days of pumping will be permitted prior to the start of dredging to remove the maximum amount of moisture from the sediments prior to dredging. This will facilitate sediment removal with minimal solidification at the removal area. Minimizing water content in sediment has the following benefits:

- Requires less solidification material, thus lowering purchase cost of solidification material.
- Decreases water weight in sediment, thus reducing disposal cost by reducing disposal tonnage.
- Decreases volume of solidification material, thus decreasing waste volume and tonnage disposal costs.
- Reduced use of solidification material reduces dust control issues associated with solidification.

The end result is a cost and safety benefit. The size, number, and location of depression wells will be subject to land access outside the creek channel footprint. Groundwater will be direct discharged into the creek channel downstream onto the energy dissipation discharge pad.

Silter Vac vacuum dewatering should be sufficient to maintain a suitably dry excavation area based on pump test results performed in February 2012. However, EQ will conduct a supplementary dewatering of isolated dredging area as needed through the use of pumps, hoses, and a frac tank. If necessary, EQ will pump standing water from the isolated section and discharge it into a frac tank for subsequent transfer via tanker/vacuum truck to the waste water treatment plant located at the John Street TCRA Support Area.

3.1.10 Pre-Excavation Toposurvey

EQ will coordinate with the EPA FIELDS Group to perform a pre-excavation survey of the removal area to fill in data gaps not captured when surveying the transect lines. This survey data will be used for multiple purposes. First, it will document the pre-removal topographical condition of the creek channel. This serves as a baseline to measure the performance of contaminated sediment removal and creek channel stabilization/backfill activities. To accomplish this, the survey data will then be loaded into the RTK-GPS equipment mounted in the excavators used for dredging to guide excavation/backfill efforts and ensure the lateral/vertical extent of contaminated sediment removal and backfill restoration is performed correctly.

3.2 Contaminated Sediment Removal

3.2.1 Water Management

Bypass pumping operations will begin subsequent to completion of the dredging area isolation and installation of the bypass pumping and dredging area dewatering (SA6 7-14) systems. Bypass pumping of creek water flow and stormwater outlets will be performed with centrifugal pumps and ancillary hoses/piping systems. Dredging area dewatering to depress groundwater for Isolation Areas SA6 7-9 and SA6 10-14 will be performed with the Silter Vac vacuum system wells and vacuum pump as previously described. All bypass and groundwater depression water will be re-introduced to the creek below the northernmost isolation dam at the north end of SA6 14. Bypass pumping and groundwater depression pumping for Grid Areas SA6 7-14 will operate 24 hours per day 7 days per week until the isolated dredging area is dredged, the area is confirmatory surveyed/sampled, toe of bank stabilization is completed, and the area is backfilled. All pumping will be terminated during rain and associated flooding events that exceed pumping capacity, and creek flow will be permitted to enter the isolated dredging area; bypass pumping will resume subsequent to flood crest. The discharge of bypass and groundwater depression pumping waters will not require a Substantial Requirements Document (SRD).

Latent water recovered from the wet excavation method prior to solidification, and any water pumped from SA 6 7-10 and SA 6 11-14 during dry removal operations will be pumped into a

frac stationed at the excavation area and periodically transferred to the John Street TCRA support area for treatment in EPA's mobile waste water treatment plant and discharged through an SRD Agreement between USEPA and the State of Michigan Department of Environmental Quality Surface Water management Division. The water will be processed through a series of settling tanks, mechanical filtration units, and granular activated carbon units.

3.2.2 Dredging of SA6-2 to SA6-6

3.2.2.1 Sediment Removal

EQ will dredge contaminated sediments from the isolated Grid SA62-6 area using a top-of-bank wet dredging approach. This is due to the sanitary sewer force main located adjacent to and crossing the excavation area as previously stated. Bypass pumping system components will be installed as depicted in Figure 4, SA6 Grids 2-6 Layout. EQ will dredge the area from atop the western bank with a long-reach excavator equipped with RTK-GPS system and modified excavation bucket. The modified excavation bucket will have a closable lid to enclose sediments in the bucket during swing operation and minimize water recovery during excavation. The excavator will place the exhumed material into a sediment solidification box that will be pumped free of latent water as needed before solidification. Water will be pumped into a holding tank to allow sediment to settle. Accumulated water from the holding tank will be periodically pumped into either a vacuum truck or tanker to transfer liquid to the John Street TCRA (WWTP). The long-reach excavator will use the modified smooth edge bucket to exhume sediments starting in the southeast corner. The excavator will dig to the specified target depth for each grid, clearing sediment from the east bank to the west bank as removal progresses to the north in a downstream direction.

EQ will then add solidification material with a second excavator to prepare the exhumed sediment for load-out and transfer to the John Street TCRA Staging Pad. EQ will use either a crystallized polymer absorbent media, corn-cob-based absorbent media, or Calciment® solidification media, or a combination of medias to expeditiously solidify exhumed saturated sediments. The polymer material is advantageous in that typically only 3% is required to absorb 300 times its weight in water. The crystalline media has a very minimal dust component. The

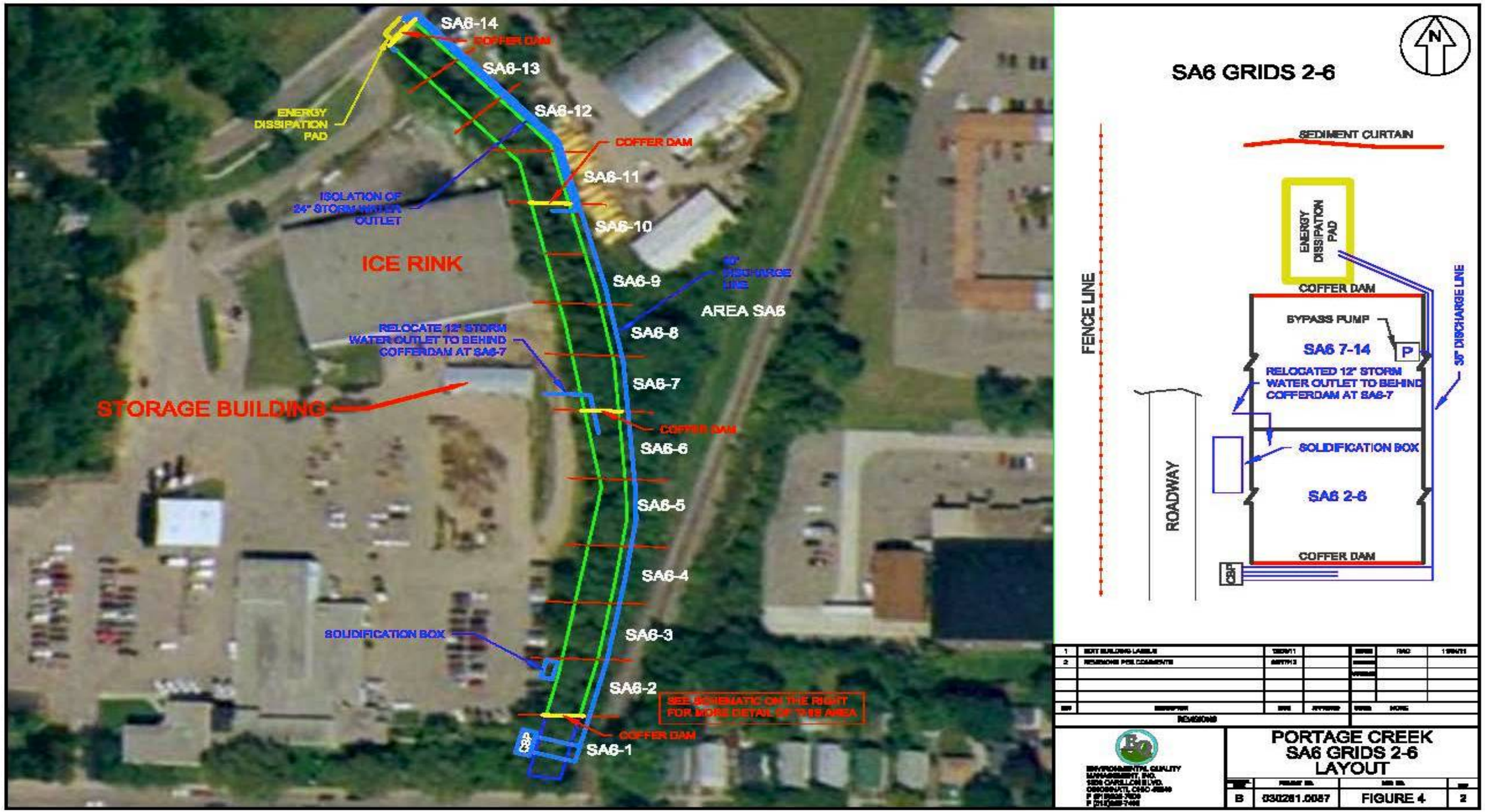

Figure 4. SA6 Grids 1-2 Layout

disadvantages are cost and absorption time, and the end matrix is a gel that creates material handling issues at the disposal facility.

The corn-cob media has similar properties to the crystalline polymer in that it can absorb up to 5 times its weight in water but also creates a gel-like material that creates handling issues at the disposal facility. Therefore, Calciment® may be added to expedite solidification and create better load-bearing material for landfill burial. Calciment® in 1-cy super sacks will be staged near the solidification box so that the solidification material can be added to wet sediment in a controlled manner with minimal dust emissions. Once sediments are sufficiently solidified, the second excavator operator will load transfer dump trucks, and material will be sent to the John Street TCRA Staging Pad.

A summary of the Wet Excavation process is described below:

1. Standing water in the isolated section will remain in place during the contaminated sediment removal process.
2. EQ will utilize a long-reach excavator equipped with an RTK-GPS system and a modified bucket assembly to excavate the isolated area from atop of the creek bank. The RTK-GPS system will allow the operator to precisely determine where excavation has taken place to total depth even though turbid water conditions may prevent visual verification. The modified bucket allows for removal of sediment without a significant collection of water. Work will begin at the upstream end of the isolated area and progress downstream as sediments are removed to target depth for respective portion of the isolated section.
3. EQ will utilize two 20-cubic-yard (cy) roll-off boxes to place exhumed material for solidification and load-out. The boxes will be positioned side by side at the top of the bank downstream from the long-reach excavator when working from the west bank. This will allow for a clear field of view for the long-reach operator when swinging the machine to place material in the box(es). A second excavator will be positioned on the opposite end of the boxes to solidify exhumed material and load it into transfer trucks for transport to the John Street TCRA Staging Pad. The boxes will be placed on plastic sheeting to ensure that any water/sediment spillage to gravity flow back into the excavation area, and thus minimize the environmental impact to the work bench on top of the creek bank.

4. The long-reach excavator will place approximately 10 to 12 cy of sediment into the box in preparation for latent water extraction and solidification. This will allow for 40 to 50% freeboard space to allow for the addition and mixing of solidification agent.
5. As material is being placed into a box and shortly after, a screened pump hose will be placed into the box to extract latent water that may be recovered with sediment. This water will be pumped into a frac tank for accumulation and settling, and subsequently transferred with a vacuum truck or tanker to the waste water treatment plant located at the John Street TCRA Staging Area. EQ may use either a pneumatic-powered diaphragm pump or vacuum pump to recover latent water from the 20-cy roll-off boxes. These pump types are preferred because they do not require priming and several inches of standing water to maintain pumping. A laborer will move the hose end around in the box as needed to recover the maximum amount of water available prior to adding a solidification agent if necessary.
6. Solidification with the second excavator will begin once a box is filled and latent water is evacuated. EQ will use either Calciment, Corn-Cob-based Sorbant media, or desiccant-based polymer to absorb water saturated within the sediment. Material will be provided in super sacks that will be staged near the solidification area. A wheel loader will lift a super sack of solidification material and dispense material through a bottom chute into the roll-off box. The chute opening will be positioned just above the sediment in the box to minimize media fall distance and thus minimize dust release into the atmosphere. A water mist spray may be needed on windy days as a dust control measure. This will be performed by the same laborer performing latent water evacuation using either a pressure washer or garden hose spray nozzle with a booster pump from a clean water tank staged close to the work area. The operator will mix material thoroughly until no sign of free water is present.
7. A fork truck or rubber-tire loader with forks may be used to bring additional solidification media from a remote storage area to supplement the material staged close to the mixing and solidification operations.
8. Solidified material will be loaded into dump trucks in a manner as previously described in this Technical Memorandum and sent to the John Street TCRA Staging Area.

3.2.2.2 Contaminated Sediment Removal and Transfer to Staging Area

Dump trucks will access the site from Stockbridge Avenue and proceed to the load-out area where they will be loaded with exhumed sediment. The load-out area will be set up to allow for containment and recovery of spillage from loading operations. Excavator operators will take special care during loading so as to not spill sediment. Truck drivers will cover their loads and

brush off loose material accumulations onto the plastic sheeting before proceeding to the truck tire wash. Truck drivers will complete a bill-of-lading shipping document prior to departing the Kalamazoo Public Services Facilities from the Stockbridge Street exit. Trucks will follow the path over Kalamazoo City streets described in the Traffic Control Plan.

3.2.2.3 Post-Excavation Sampling

EQ will support the START contractor in post-excavation sampling of the contaminated soil removal area following the methods and procedures described in the confirmation sediment collection sampling described in the FSP. EQ will provide laboratory analyses through a competitively procured laboratory. Sampling and analyses will be performed in accordance with the QAPP and FSP prepared by EQ for the site dated September 2011 and August 2011, respectively. Sampling locations will be marked in order to document locations during post-excavation survey operations. Turnaround time for sample analyses will be determined at/or near the time of collection subject to time constraints with other site operations. If cleanup performance standards/goals are met in all areas of contaminated soil removal, work will proceed to close out the excavation. If a portion of any area and/or all areas fail to meet performance standards/goals, an additional 6 inches will be excavated and the area re-sampled. The sampling and excavation process will be repeated as needed (or as directed by the EPA OSC) until the entire excavation area meets cleanup performance standards/goals before proceeding with excavation closeout activities.

3.2.2.4 Post-Excavation Survey

EQ will coordinate with the EPA OSC and EPA FIELDS Group to conduct post-excavation surveying as described in Section 3.2.2.7, and EQ will prepare as-built drawings and make required volume removal calculations.

3.2.2.5 Toe of Bank Restoration

Toe of banks will be restored as described in EQ's Restoration Plan dated September 2011.

3.2.2.6 Backfill of Creek Bottom

Subsequent to toe of bank restoration (if required), EQ will begin deploying a sand and gravel mix (bank run) to backfill the creek bottom in accordance with EQ's Restoration Plan dated September 2011.

3.2.2.7 Post Backfill Survey

EQ will coordinate with the EPA OSC and EPA FIELDS Group to conduct post-excavation surveying of SA6 grids subsequent to successful removal of contaminated soil to cleanup performance standards/goals. The EPA FIELDS Group will perform post-excavation surveying to document removal depths. The EPA FIELDS Group will provide survey data to EQ to generate as-built drawings and make cut-to-fill calculations to determine the volume of contaminated soil removed.

3.2.3 Excavate Grids SA6-7 to SA6-9 and SA6-9 to SA6-14

EQ will excavate contaminated sediments from the two isolation areas in basically the same manner by using a long-reach excavator from atop the western bank of Portage Creek to dredge the grid areas in the dry. Figures 5 and 6, SA6 Conceptual View Isolation Water Management, and SA6 Grids 7 to 14 Layout, depict the installation of water management controls to be used to facilitate dredging in the dry.

The dewatering subcontractor will install Silter Vac vacuum extraction wells and well points prior to excavation to draw down and bypass groundwater into these two isolation areas to maximize water removal from the sediment prior to excavation. This operation is depicted in the schematic on the right side of Figure 6, SA6 Grids 7-14.

Once water management controls are in place, the long-reach excavator with RTK-GPS and a smooth bucket will begin excavating contaminated sediments from the southeast corner of SA6-7 and continue working to the north. The use of the solidification box and solidification media will be incorporated as needed. The remainder of the operations will be performed in a similar manner as those presented in Section 3.2.2.

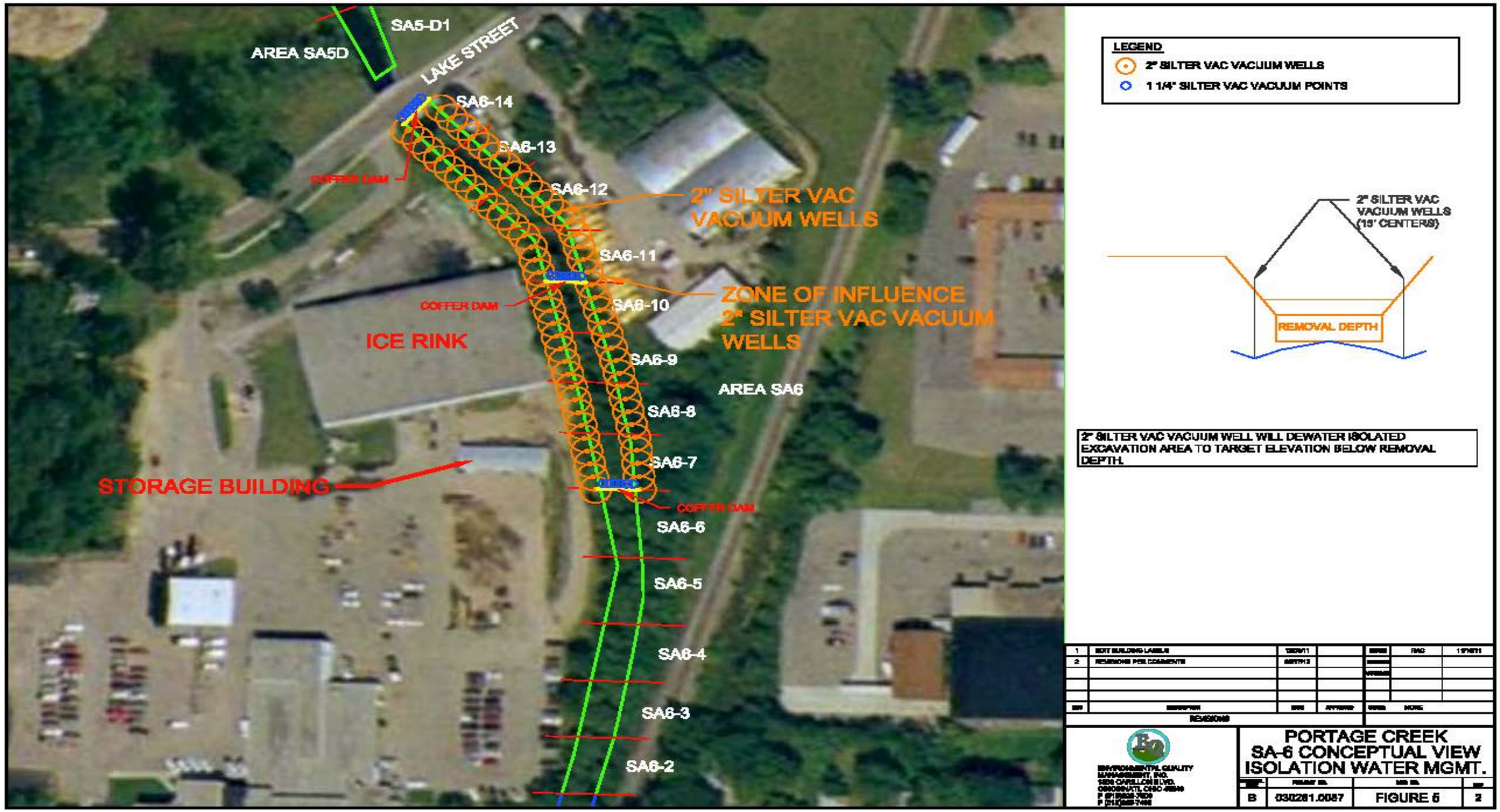

Figure 5. SA6 Grids 3-7 Layout

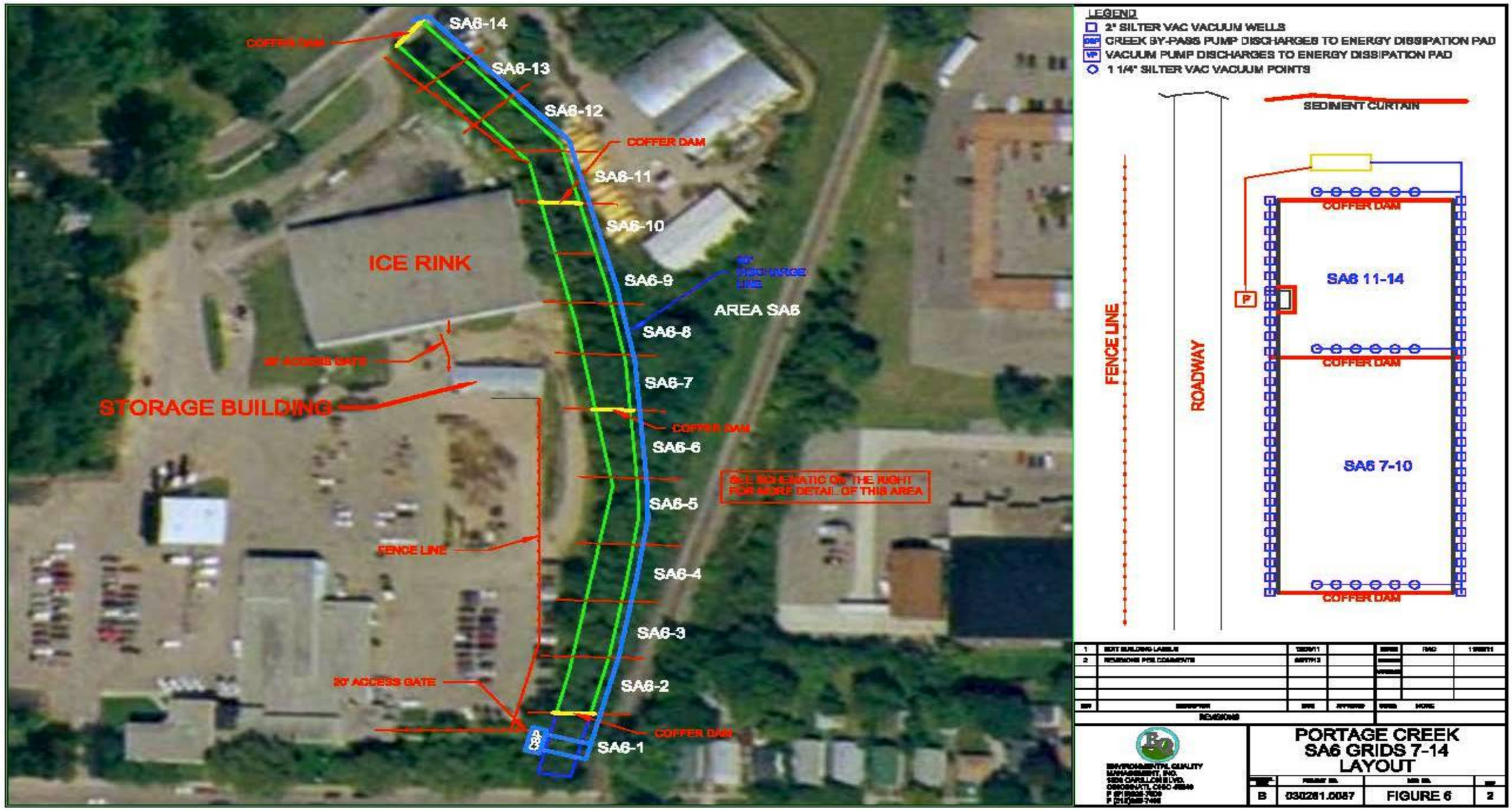

Figure 6. Conceptual View of Isolation Water Management

3.2.4 Site Restoration

3.2.4.1 Removal of Excavation Facilities and Equipment

EQ will remove non-essential facilities and equipment from the work area to restore the site to pre-existing conditions. The fuel tank, excavation equipment, tire wash station, cofferdams, pumps, pipelines, etc., will be removed.

3.2.4.2 Restoration Planting

EQ will perform restoration planting as described in EQ's Restoration Plan dated September 2011. The final restoration design plan will include stakeholder input accepted by EPA and directed to EQ.

3.2.4.3 Restoration Planting Monitoring

EQ will provide monitoring and corrective action/maintenance for a period of 1 year from the restorative planting date or as directed by EPA in accordance with EQ's Restoration Plan dated September 2011. EQ will also maintain erosion sediment controls until re-vegetation planting is accepted or as directed by EPA.

3.2.4.4 Facility Impact Repair

EQ will make repairs to the Kalamazoo public services facility caused by sediment removal operations. EQ, EPA, and City of Kalamazoo Public Services management personnel will review pre-existing photo-documentation to develop a punch list of repair items to be addressed prior to complete demobilization from the SA6 contaminated sediment removal area. EQ anticipates at a minimum that this will include perimeter fence repair/replacement, lawn repair and landscaping of disturbed areas, asphalt/concrete patching, and general housekeeping.